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AUTHOR Snyder, Sarah A.
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ABSTRACT

This teacher's guide presents teaching suggestions and presentation materials about natural resources as economic assets contributing to national economic productivity. The term "natural resource accounting" or "green accounting" is introduced for valuing natural resources as capital in economic systems. The lesson is divided into five parts and can be taught in two or more class periods. Student handouts include: (1) "Facts about Indonesia and Japan"; (2) "Facts about National Income Accounting"; and (3) "What Happens When Natural Resources Are Taken into Account?" Transparency masters offer "Costa Rica's Agricultural Product before and after Natural Resource Depreciation"; "Comparison of Indonesia's Gross Domestic Product (GDP) and Net Domestic Product (NDP), 1971-1984"; and "Comparison of Indonesia's Gross Domestic Investment (GDI) and Net Domestic Investment (NDI), 1971-1984." (EH)

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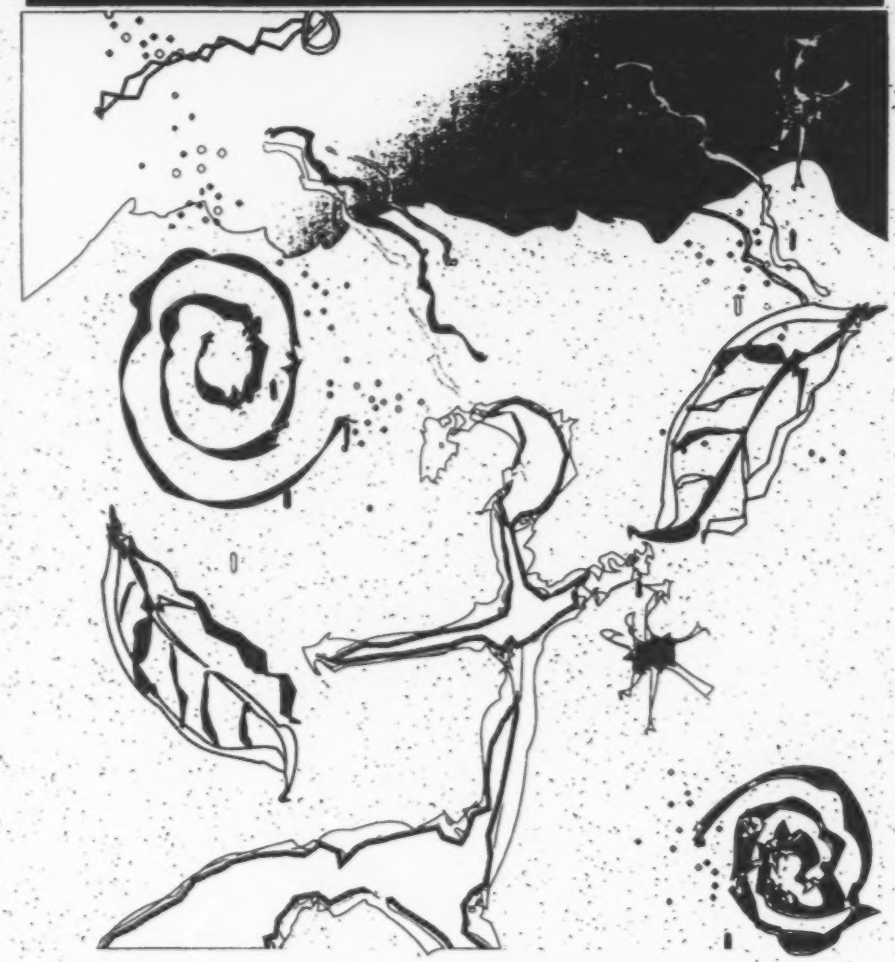
TEACHER'S GUIDE

To World Resources

Natural Resource Economics



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to

World Resources:

Natural Resource Economics

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The *Teacher's Guide to World Resources: Natural Resource Economics* is produced by the World Resources Institute Environmental Education Project, Mary Paden, Environmental Education Director; Kathleen Courrier, Publications Program Director.

Mary Paden, *Editor*

Sarah A. Snyder, *Author*

Deborah Farmer, *Associate Editor*

Kathy Doucette, Maggie Powell, *Production Coordinators*

Daniel P. Nielsen, Susanne Kamalieh, *Computer Graphics*

Wohler & Company, Alexandria, Virginia, *Cover Art*

Teacher's Guide Advisory Committee

The following educators offered invaluable reviews and advice on content and presentation.

Dr. Thomas Marcinkowski, *Florida Institute of Technology, Melbourne, Florida*

Mr. James Sproull, Project *JEDI, U.S. Geological Survey, Mercer Island, Washington*

Ms. Martha Sharma, *National Cathedral School, Washington, D.C.*

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Dr. William Lawrence, *Concord Academy, Concord, Massachusetts*

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Teacher's Guide

to

World Resources:

Natural Resource Economics

Comprehensive Coursework on the
Global Environment

World Resources Institute
1709 New York Avenue, N.W., Washington, DC 20006

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The World Resources Institute (WRI) is a research and policy institute helping governments, the private sector, environmental and development organizations, and others address a fundamental question: How can societies meet human needs and nurture economic growth while preserving the natural resources and environmental integrity that make prosperity possible?

Through its policy studies, WRI aims to generate accurate information about global resources and environmental conditions, analyze emerging issues, and develop creative yet workable policy responses. In seeking to deepen public understanding, it publishes a variety of books, reports, and papers; undertakes briefings, seminars, and conferences; and offers material for use in educational settings and in the news media.

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Using World Resources Teacher's Guide Units

World Resources *Teacher's Guide* Units are designed for use at the secondary school level (although we have reports of successful use at the middle school and college levels). They weave together lessons about both environment and development, both globally and locally. They draw on skills and knowledge from the physical and biological sciences, social studies, history, economics, civics, and global studies.

Information and analysis used in the Units are drawn from World Resources Institute (WRI) publications and databases. All units are written by curricula writers and reviewed by educators as well as by technical experts. The Units are updated and revised periodically based on feedback from classroom teachers who have used the materials.

Our intent is to provide easy-to-use, inexpensive classroom materials that contain the most recent and authoritative information on the global environment because we believe it is crucial that the next generation of leaders and citizens understand the issues described here.

The complete set of *Teacher's Guide* Units includes the following topics:

- Biodiversity
- Car Trouble
- Citizen Action
- Energy, Atmosphere, and Climate
- Natural Resource Economics
- Oceans and Coasts
- Population, Poverty, and Land Degradation
- Sustainable Development
- Two Giants: China and India
- Watershed Pollution
- Women, Equity, and Sustainable Development

These units have been revised and updated with the most recent data available as of spring 1994.

Inside Each Unit

Each *Teacher's Guide* Unit should contain enough teaching suggestions and presentation materials to teach one to several classes on the topic without securing additional resources. On the other hand, each unit is designed to point teachers and students to additional resources and to offer suggestions for expanded coursework. Specifically, each unit contains objectives, a lesson plan, student handouts, overhead transparency masters, student enrichment activities, suggestions for further reading, and suggested audiovisual resources.

Using the Units for Environmental Studies

The *Teacher's Guide* Units provide a comprehensive, consistent yet highly flexible set of materials for environmental studies courses. They can be used in conjunction with an environmental science textbook to give students an understanding of basic environmental systems and cycles. Or they can be used in a social studies context to examine some of the tough problems and choices we face as a society.

Educators who want to go beyond the *Teacher's Guide* Units can read related WRI publications, which provide the basic data, source materials, and analysis for the Units. These publications are listed at the beginning of each unit. A free catalog can be obtained by calling 1-800-822-0504.

Integrating Teacher's Guide Units into the Curriculum

Secondary school teachers frequently mention the difficulty of integrating environmental issues into a tightly packed curriculum. As much as they would like to teach about the environment, they must devote class time to required subjects.

To help them place these issues in their curricula, we have coded each lesson plan and each student enrichment activity to the draft national performance assessment standards for science, math, history, civics, and geography. These standards are being developed as part of the national Goals 2000 program in the U.S. Department of Education. The standards themselves are being developed, discussed, and revised by educational organizations in nine academic disciplines. They are expected to be approved at the national level, then offered to states to incorporate into their own academic assessment plans. Although this process will take several years, we have compiled lists of assessment standards for grades 9 through 12 from drafts available in spring 1994 to offer some guidance to teachers.

A complete list of the draft standards for Grades 9 through 12 appears in Appendix B, which should be mailed to you with your order. Appendix A provides a bibliography and list of related organizations.

Integrating Global Environmental Education into High School Curricula

In an effort to link lessons about global environment and development issues to required school curricula, we have identified which pages of the lesson plan and which student enrichment activities in this Teacher's Guide Unit relate to the draft national performance standards developed recently for civics, geography, history, math, and science in grades 9 through 12.

These voluntary national standards are part of the Goals 2000 program mandated by the Goals 2000: Educate America Act of 1994 under the direction of the U.S. Department of Education. Among other things, Goals 2000 will establish a set of goals or performance standards for grades 4, 8, and 12 in the subjects listed above plus English, the arts, and foreign languages. These goals will be available to the states for incorporation into their own sets of educational performance standards. Each set of draft standards was developed by a professional education organization and has been presented at numerous educational conferences for review and comment. The draft standards used here are those available as of spring 1994.

Although many countries have national performance standards, the United States (and Canada) have treasured a decentralized educational system that sets education goals at the district or state level. Goals 2000 is the first attempt to identify a set of general education objectives that all students in the country are expected to achieve. As might be expected, there is some controversy over whether there should be national education goals—even voluntary ones—and if so, what they should be.

Regardless of the final outcome, we feel the draft goals do reflect some consensus among educators about what material should be covered at various grade levels, and as such, offer some guidance for integrating environmental education into the curricula.

Only those goals relevant to this unit are listed here. A complete list of goals appears in the 1994 *Teacher's Guide to World Resources*. Copies of reports outlining the goals for each subject area can be obtained from the education organizations listed at the top of each set of goals on this page. Information about the Goals 2000 program is available at 1-800-USA-LEARN.

Goals 2000: Draft National Performance Standards

Geography*

(Draft National Standards, October 1993, National Council of Geographic Education, Geography Standards Project, 1600 M Street, NW, Washington, DC 20036)

	Lesson Plan	Enrichment Activity
I. Seeing the World in Spatial Terms		
1. Knows and understands how to use maps, globes, and other graphic tools and technologies to acquire, process, and report information from a spatial perspective.		3
IV. Human Systems		
11. Knows and understands patterns and networks of economic interdependence on Earth's surface.		3

Mathematics*

(Draft National Standards, March 1989, The National Council of Teachers of Mathematics, Order Processing, 1906 Association Drive, Reston, VA 22091)

	Lesson Plan	Enrichment Activity
I. Mathematics as Problem Solving		
2. Apply integrated mathematical problem-solving strategies to solve problems from within and outside mathematics.	6, 8, 9	
4. Apply the process of mathematical modeling to real-world problem situations.		1, 3
II. Mathematics as Communication		
3. Express mathematical ideas orally and in writing.		1
III. Mathematics as Reasoning		
3. Follow logical arguments.	6, 7	
IV. Mathematical Connections		
4. Use and value the connections between mathematics and other disciplines.		1
VI. Functions		
1. Model real-world phenomena with a variety of functions.		1, 3
2. Represent and analyze relationships using tables, verbal rules, equations, and graphs.		3

Note: Only the education goals relevant to this unit are listed.

Science*

(Draft National Standards, February 1994, National Academy of Sciences, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418)

	Lesson Plan	Enrichment Activity
III. Life Science		
1. Biodiversity		2
4. Ecosystems and Human Ecology	1-3, 6, 8-10	1, 2
V. Unifying Concepts And Processes Of Science		
2. Conservation	1-2, 4-10	1, 2
VI. Science and Technology		
1. Problem Identification		1
VII. Science and Societal Challenges		
1. Population Growth	3, 4	
2. Natural Resources	1-10	1, 2
3. Environmental Degradation	4-10	1, 2
4. Natural and Human-Induced Hazards	4	1, 2
5. Community Health	4	1, 2

Natural Resource Economics

Just as the parent of a sick child anxiously reads a thermometer, so do government economists and policymakers study the nation's gross national product (GNP) each time it is compiled. The rate of growth of the GNP is considered to be the chief measurement of economic progress and development and thus of the quality of life. The parent of a sick child is reasonably certain the thermometer will give an accurate reading. But can economists rely on the GNP to give a realistic indication of the health of the nation's economy?

The GNP and other current methods of national income accounting ignore the importance of natural resources, especially on a long-term basis. But natural resources do make important contributions to national economic productivity. Resources such as soil, forests, and minerals are *economic* assets that contribute to the quality of life. Since they are natural (i.e., part of nature), they are also an integral part of the structure and healthy functioning of ecological communities and ecosystems. As such, they may be seen as *ecological* assets that contribute to the quality of the environment.

In some instances, humans strive to maintain a healthy balance between the quality of life and the quality of the environment. However, natural resources frequently have been, and are still being, seriously affected by human activities. In general, humans tend to "trade-off" short-term for long-term goals and to choose socio-economic benefits over environmental (ecological) ones. New methods of planning and development are needed to meet current needs without sacrificing long-term economic growth, quality of life for future generations, or the quality of the environment. The environmental consequences of economic development must be considered in both developed and developing countries.

Planning for sustainable development requires changes in economic policies at both the national and international levels. For example, national economic policies include subsidies (for planting certain crops) and tax incentives (to clear forests, settle land, etc.). International issues include trade policies, debt repayment, and agreements about global problems such as ocean pollution. Another important influence on economic development is the inequality of nations in both financial resources and natural resources.

One new concept that may be useful in planning for sustainable development is *natural resource accounting*, sometimes called *green accounting*. This is a mechanism for valuing natural resources as capital in our economic systems. Natural resource accounting provides for the depreciation of natural resource assets.

There is growing recognition of the need for natural resources accounting. *Our Common Future*, the 1987 report of the World Commission on Environment and Development, stated: "In all countries, rich or poor, economic development must take full account in the measurements of growth of the improvement or deterioration in the stock of natural resources."

Various methods of natural resource accounting are being studied by international institutions such as the United Nations and the World Bank. The World Resources Institute has developed one method, discussed in this lesson, and is using this method for research in Costa Rica, China, and the Philippines. Recent research in another country, Indonesia, is highlighted in this lesson. Several countries have proposed or set up systems of environmental accounts, among them Norway, France, Canada, Japan, and the Netherlands. The United Nations working group on National Accounts recently released the *Revised System of National Accounting* which tells countries how to keep a separate national account for the environment and natural resources (see reading list).

This lesson is based on work done in World Resources Institute's Economics and Population Program. Source documents are listed in the order form at the back. The lesson begins with a comparison of two countries, Japan and Indonesia, then focuses on economic growth in developing countries. Next, economic measurements, such as the GNP, are introduced, along with the fact that current accounting methods do not include resource capital. This stock of valuable resource capital is currently being spent as though it were income, which must eventually lead to resource bankruptcy. The potential usefulness of natural resource accounting is introduced through a case study of Indonesia. The lesson concludes by considering general questions relating to the relationship between economic development and the environment.

Objectives

By the time they finish this lesson, students should be able to:

- Describe some of the differences between the economies of developed and developing countries.
- Communicate differences and similarities in how developed and developing countries use their natural resources.
- Explain the difference between renewable and nonrenewable resources.
- Define Gross National Product (GNP) and describe its importance and its limitations as an economic index.
- Explain how accounting for natural resources affects statistical measurements of a country's economic growth.
- Give some examples of how economic policies in both developed and developing countries ignore or degrade the environment.
- Understand why long-term economic growth is dependent on preservation of the environment.

Teaching Strategies

This lesson is divided into five parts. Allow two class periods, or more if you wish, to relate this lesson to other lessons.

The lesson includes the following materials that may be duplicated.

Student Handouts

1 Facts About Indonesia and Japan
2 Facts About National Income Accounting
3 What Happens When Natural Resources Are Taken Into Account?

Overhead Transparency Masters

1 Costa Rica's Agricultural Product Before and After Natural Resource Depreciation
2 Comparison of Indonesia's Gross Domestic Product (GDP) and Net Domestic Product (NDP), 1971-84
3 Comparison of Indonesia's Gross Domestic Investment (GDI) and Net Domestic Investment (NDI), 1971–84

Beginning the Lesson

Distribute copies of **Handout 1, "Facts About Indonesia and Japan."** After students have identified differences between the two countries, discuss the general characteristics of developed and developing countries below. Note that Japan is clearly a developed country. Indonesia is a developing country on its way to becoming a newly industrialized nation.

Developed countries—the United States, Japan, Canada, etc. have market economies based on large stocks of capital goods. They have industries using advanced technologies and well-educated labor forces. Industrialized countries tend to import raw materials and export manufactured products and services. Only a small percentage of the population is involved in agriculture. Most workers are in the manufacturing and service sectors. The standard of living is generally high.

Newly Industrialized Countries—are just now making the shift from an agricultural economy to a manufacturing economy. Their GNPs and standards of living are rising, but development is often uneven, with large gaps between rich and poor as well as a growing middle class. Many of these countries are following the old route of the developed countries by first relying heavily on extracting natural resources and then shifting to manufacturing. Some countries are attempting shortcuts that jump a generation of technology to move directly from agriculture to an information-processing economy.

Developing countries—have rapidly growing populations, and much of the population is engaged in agriculture. There is a small amount of industry with primitive production techniques and low labor force productivity. Unemployment may be high. Exports consist mainly of agricultural commodities (such as sugar, rice, bananas, etc.) and raw materials (timber, oil, copper, etc.). There are lower standards of living, education, health care, etc. Many people live at a subsistence level, and some suffer from extreme poverty. Literacy levels are lower than in developed countries.

Discussing Economic Growth in Developing Countries

Why are natural resources so important for developing countries? All economic activity depends on natural resources and biological and chemical processes, but natural resources are especially important for developing countries. To meet the needs of rapidly growing populations, developing countries have to draw on natural resources to do the following:

- *Finance economic growth.* Money is needed to buy goods and services from other countries (cars, computers, paper, airplanes). The developed countries already have a plentiful supply of capital goods accumulated over the years.
- *Meet current expenses.* To build factories, roads, mines, dams, schools, etc., developing countries have borrowed from developed countries. During the 1980s, foreign debt became a significant problem for many developing countries. For example, the foreign debt of African countries tripled during the 1980s. These loans must be repaid in the currency of the lending country. To get foreign exchange currency to repay the loans, the developing country must export commodities.

To obtain commodities for export, the developing countries exploit their natural resources. Some of these resources are renewable if managed carefully: soil and water to raise food crops and livestock; fisheries; and forests. Other resources are nonrenewable: minerals, oil, natural gas, etc. Often, a country is heavily dependent on just one or a few resources. A decline in world commodity prices seriously affects that country's economy. The country must then export more to earn the same export income. (See **Student Enrichment Activity 3, "Follow Commodity Prices."**)

To what extent are developing countries exploiting their resources? What is the impact on the environment?

In many cases, government policies to achieve economic development are generally ignoring or destroying valuable natural assets. The policies produce short-term income at the cost of long-term income. Examples include the following:

FORESTS: In many cases, governments a) lease tree-cutting concessions to timber companies for very little money, thus not returning a fair share of the profits to the public coffers, b) place no value on the trees in their bookkeeping system, thus don't even notice the loss of national assets, and 3) fail to require replanting and forest management to insure regrowth.

SOILS: When soils are used continuously for agriculture, or are exposed to wind and rain because of deforestation, they erode and lose nutrients. Such soils can become degraded and lose their productive capacity. Poor soils grow poor crops. They are clearly of less value than rich soils.

Why shouldn't developing countries use their natural resources to develop in the same way that the developed countries did? Isn't that only fair?

Developing countries should and must develop their natural resources. However, today, they face pressures that the developed countries did not face in the past when they cut their forests, built factories, and began large-scale mining. Developing countries have been influenced both by their history and by recent trends. These include the following:

1. *Population pressure:* In 1890, when the United States was industrializing, it had 21.2 people per square mile. In 1989, when Indonesia was industrializing, it had 244 people per square mile. Today,

developing countries must meet the needs of large, growing populations at the same time they are attempting to develop.

2. *Colonialism:* Most developed countries not only had generous endowments of natural resources within their borders, but as colonial powers, they drew on resources around the world. Many developing countries, such as India and the Philippines, were once colonies whose resources were heavily exploited before the country gained independence. Colonial powers also restricted the trade of their colonies and allowed them to develop only in ways that benefited the mother country.

3. *Resource endowment:* If a well-endowed country squanders some of its resources, it may have other resources to develop. However, if a country such as Sudan or Niger that has few resources squanders them, the result can be land degradation and famine.

4. *Conversion of forests to farmland:* When forests in developed countries such as the United States were cleared, the soil was rich and the land was suitable for farming. The soil under many tropical forests, however, is thin and nutrient poor. In most cases, the soil will not sustain agriculture.

5. *Accelerated change:* Advances in technology and communication have speeded the pace of development. Change occurs more rapidly now than it did in the past when developed countries industrialized. For example, it took 10 years to deforest 20 million acres in the United States, between 1860 and 1870. In 1987, it took only 1 year to deforest 20 million acres in the Amazon.

6. *Debt burden:* Large public debt was not a major problem in the past but today, debt is a major problem for many developing countries. In only 10 years, between 1977 and 1987, Brazil's external debt rose from 13 percent to 29 percent of its GNP. Nigeria's debt increased from 2 to 112 percent, Zaire's from 34 to 143 percent, and Bolivia's from 46 to 115 percent of GNP.

7. *Lessons in sustainability:* Over the past hundred years, scientific knowledge of how natural systems work and how to manage these systems has improved dramatically. Now that we have polluted most of the coastal areas, damaged the ozone layer, and altered the atmosphere in ways that could bring on changes in climate, we are beginning to understand that human actions can seriously alter the balance of natural systems. The information base and the technology are being developed to manage resource systems in both developed and developing countries much more efficiently than was possible in the past. (Ironically, many traditional societies had developed sustainable practices that were ignored or overridden by both colonial powers and succeeding governments.)

Discussing Economic Measurements

Just as grades are used to track a student's progress in school, certain types of measurements are used to track the performance of a country's economy. These measurements are used by policymakers to shape future economic policy.

Distribute copies of **Handout 2, "Facts About National Income Accounting,"** and allow students a few minutes to read the handout. Emphasize the following points in discussing the information on the sheet:

- The same measurements are used to measure the economies of both developed and developing countries.
- Current methods of national income accounting ignore the two main assets of developing countries: natural resources and human resources.
- Current accounting methods confuse the depletion of valuable assets with the generation of income. For example, if a country sells off its oil, its income goes up. No allowance is made for the fact that the country no longer possesses the oil reserve. However, a gas station counts the gasoline in its underground tanks as an asset. In its bookkeeping system, an empty tank is worth less than a full tank. As gasoline is sold, a gas station accountant would recognize that the station has fewer assets but more cash from sales.
- Current accounting methods overstate the level and growth of income in developing countries.
- New, more accurate methods of accounting are needed to gauge long-term, sustainable growth. These methods should extend the concept of depreciation to natural resources.

Note: Be sure students understand the concept of *depreciation.*

To economists, the term *depreciation* refers to the cost of replacing capital that is used up in the production process. For example, if a farmer buys a tractor that he expects to last 10 years, he estimates a depreciation cost for each year. (The yearly depreciation could be one tenth the cost of replacing the tractor, or a higher figure could be assigned to the first few years and a lower figure to later years.) Green accountants apply the concept of depreciation to natural resources such as soil, forests, and minerals that are used to produce goods and services.

Contrasting Examples

Discuss the following examples:

1. A farmer needs a new barn. To get the money to build the barn, he cuts and sells the timber in a woodlot he owns. In doing this, he sells off one asset to gain a new one. He needs the new barn more than he needs the timber, so he considers himself better off. The barn will help him continue to earn a living by farming.

2. Instead of building the barn, the farmer sells his timber and spends the money on food, clothes, a new car, and some CDs. After the money is gone, the farmer is poorer. He has neither the money, nor the timber, nor a new capital base.

3. The farmer sells his timber, builds a barn, and replants his woodlot. When the trees mature, he will have more assets than before—both a barn and a woodlot. Or he might selectively harvest the woodlot and invest the money until he has enough to build a barn.

The first example is analogous to the developing country that extracts and sells natural resources in order to build factories. In such a situation,

one asset is exchanged for another. Many countries have developed in this manner. The second case is parallel to the developing country that exploits natural resources and wastes the money, allows it to be siphoned off by corrupt officials, or uses it to pay current expenses such as interest on foreign debt. The country becomes poorer because the money from one asset is not invested in another productive asset. In the third case, the farmer both invests wisely and husbands his natural resources. He ends up the richest in the long run.

Accounting for disappearing soil. To understand how the depletion of a natural resource can be reflected in the national accounts, take the case of Costa Rican soils. Green accountants asked soil scientists to help measure the economic contribution of soil to the final marketable food product. They came up with a method of calculating a) how much soil typically eroded from agricultural land, b) the types of nutrients (nitrogen, phosphorus, potassium) that soil contained, and c) the cost of fertilizer and labor to replace those nutrients. This figure was the soil "depreciation." **Overhead Transparency Master 1, "Costa Rica's Agricultural Product Before and After Natural Resource Depreciation,"** shows that when the soil depreciation figure was subtracted, the "net" agricultural product was worth only *half* its "gross" value. In other words, half the value of Costa Rica's agricultural output depended on "free" environmental services (good soil), which was being depleted yearly—clearly an unsustainable situation.

Examining One Example of Natural Resource Accounting

How can the value of a country's natural resources be established? For example, what was the value of the mangrove swamps in Ecuador that were destroyed to expand the shrimp business?

A workable technique must be developed for valuing natural resources. This standard method of accounting then could be used by statisticians in different countries. Various systems are being proposed. As summarized in *Environmental and Natural Resource Accounting: Where to Begin*, free from WRI (see "Suggestions for Further Reading"), a study of Indonesia by the World Resources Institute shows the potential for natural resource accounting.

Case Study: Indonesia

(Robert Repetto, *et al., Wasting Assets: Natural Resources in the National Income Accounts*)

Indonesia has had the third highest area of forest cleared each year. About 40 percent of the country is covered with tropical rainforests, mostly in Kalimantan (Indonesian Borneo), Sumatra, and West Irian. These forests contain valuable tropical hardwood, perhaps the most valuable in the world. The policies of the Indonesian government have favored logging and the development of forest-based industry: for example, factories built to make plywood. Logging typically damages trees that are left, leaving a much degraded forest.

Even more influential are government policies favoring converting forest land for agriculture. The Indonesian government took out a full-page advertisement in a U.S. magazine to explain that because its people have the same aspirations as people in the United States, 20 percent of its forests must be converted to plantations to produce teak, rubber, rice, coffee, and other agricultural commodities.

To open up new land for agriculture, the government has promoted resettlement schemes, moving large numbers of people from the densely settled islands of Java, Bali, and Madura to the sparsely populated Outer Islands. However, these islands don't have good, unused agricultural land. The forest soil is nutrient-poor and erodes easily.

In most cases, these government policies have led to waste. The economic benefits of timber harvesting rarely enrich the government or the community. Most of the profits have gone to domestic and foreign companies who are awarded timber concessions and to the politicians and military officers who are often their silent partners. Between 1979 and 1982, Indonesia's government sacrificed over $2 billion of potential forest revenues to holders of logging concessions and allied interests.

Economic Background

Primary production (agriculture, fishing, forestry, production of oil and gas, and mining) has contributed 44 percent of Indonesia's gross domestic product (GDP). (Gross *domestic* product is the same as gross *national* product *except* that it does not include foreign earnings. Foreign earnings include money a country makes on its holdings abroad.) Primary production also accounts for 84 percent of exports, and 55 percent of total employment. Indonesia's economic growth, as measured by current accounting methods, has been successful.

The WRI study, which takes into account depreciation of natural resources, gives a different picture of the country's economy. Student **Handout 3, "What Happens When Natural Resources Are Taken Into Account?"** contains information from this study. In this study, the net domestic product was figured by subtracting from the GDP estimates of net natural resource depreciation for three sectors: petroleum, timber, and soils.

Distribute copies of **Handout 3, "What Happens When Natural Resources Are Taken Into Account?"** and allow students time to study the table and answer questions. Then, discuss the answers:

1. a, b, e. Point out that this limited study does not include other resources such as natural gas, coal, copper, tin, nickel, nontimber forest products, and fisheries. *How might estimating depreciation for these other resources affect the country's NDP?*

2. The amount of petroleum available increased in 1971–74 due to the discovery of significant oil reserves. (Oil has accounted for more than 50 percent of export earnings and government revenues since 1967, and it has financed rapid growth in investment and consumption expenditures. However, production is now declining in most major oil fields, and future production prospects are mediocre.)

3. Timber decreased each year due to logging operations and transfer of forest land to other uses. Indonesia also suffered disastrous forest fires. Soil, which is essential for agricultural production, suffered erosion each year as the steep hillsides were cleared for farming. The economic consequences of soil erosion include loss of nutrients and soil fertility and increased sedimentation in reservoirs, harbors, and irrigation systems, which affect both fisheries and downstream water users.

4. 7.1 percent

5. 4 percent

6. In two years (1971 and 1974), the NDP is actually higher than the GDP due to the discovery of oil reserves. But, the NDP is usually less than the GDP. By subtracting estimates of natural resource depreciation from the GDP, a more realistic estimate of economic growth can be made. If natural resource depreciation is not taken into account, the GDP overstates net income and its growth.

Show a transparency made from **Overhead Transparency Master 2, "Comparison of Indonesia's Gross Domestic Product (GDP) and Net Domestic Product (NDP), 1971-84."** Point out that this graph is a visual representation of the GDP and NDP data in the student exercise. The graph clearly shows the relationship between the GDP and the NDP.

Show a transparency made from **Overhead Transparency Master 3, "Comparison of Indonesia's Gross Domestic Investment (GDI) and Net Domestic Investment (NDI), 1971-84."** The gross domestic investment shows gross investment in productive capital. The net domestic investment reflects natural resource capital. The graph clearly shows the effect of the discovery of petroleum reserves, which made the NDI higher than the GDI at several points (because the country's natural resource capital increased). But on the whole, the NDI is lower than the GDI. This means that the country is drawing down, rather than building up, its assets base. Natural resources are being used to finance current consumption.

Explain that resource-dependent countries, such as Indonesia, must diversify their asset base if they are to achieve sustainable, long-term growth. They can't depend on either a single commodity or natural resources, such as copper or tin, that will eventually be exhausted. To diversify, a country must invest the money from the sale of natural resources in new productive resources such as factories, just as in the case of the farmer who sold his timber to pay for a barn.

Concluding the Lesson

Use **Handout 2, "Facts About National Income Accounting,"** to move from the case study of Indonesia to consideration of more general issues.

Discuss the sections on Trends and Recommendations. Additional questions for discussion or research include:

- *What is the advantage of Green Accounting?* Accurate measurements will help policymakers obtain realistic figures to use in planning for the future. Accounting for depletion of natural resources will help people realize that development cannot be economically sound in the long run unless it is environmentally sound.
- *What is sustainable economic development and how can it be achieved?* In order to achieve sustainable economic progress, renewable natural resources must be regrown as they are harvested so that there is always the same amount of "capital" resources.
- *What kinds of economic policies protect the environment?* Examples include fossil fuel taxes to encourage energy efficiency and technology development, emission charges to discourage pollution, and deposit-refund systems (for glass bottles, for example) that discourage waste.
- *What kinds of economic policies ignore or destroy the environment?* Examples include subsidies for converting forests to farms and cattle ranches, resettlement projects, and government subsidies for irrigated water that give farmers no incentive to conserve water.
- *How can developed countries aid developing countries in achieving sustainable economic development?* Policies for international trade, investment, technology transfer, and finance could be changed to give support to developing countries.
- *How can Natural Resource Accounting be applied in developed countries?* In industrialized countries, where the economies are based more on manufacturing and services than on farming, forestry, and mining, green accounting systems consider the economic damage done by pollution to human health, natural resources, and the built environment.

Suggestions for Further Reading

- Carrie Meyer, *Environmental and Natural Resource Accounting: Where to Begin*, Issues in Development Series (World Resources Institute, Washington, D.C., 1993) Free.
- Tropical Science Center and World Resources Institute, *Accounts Overdue: Natural Resource Depreciation in Costa Rica* (World Resources Institute, Washington, D.C., 1991).
- Robert Repetto, *Promoting Environmentally Sound Economic Progress: What the North Can Do* (World Resources Institute, Washington, D.C., 1990).
- Robert Repetto, *The Forest for the Trees? Government Policies and the Misuses of Forest Resources* (World Resources Institute, Washington, D.C., 1988).
- Robert Repetto, William Magrath, Michael Wells, et al., *Wasting Assets: Natural Resources in the National Income Accounts* (World Resources Institute, Washington, D.C., 1989).

1 Investigate Costs of Pollution

If the environment is ignored, the process of economic development leads to environmental degradation and pollution. Evidence of this is abundant, whether it is a river polluted by industrial wastes or smog that irritates one's eyes and throat. Currently, national income accounting does not take into account the costs of pollution. And, cleaning up the environment may actually raise the GNP. If toxic substances leak from a landfill and pollute local water and the government spends millions to clean up the pollution, the national income rises. Such expenditures are seen as purchases of goods and services.

Have students gather evidence of the costs of pollution in their area or region, or in the United States. Each student could research one "cleanup" project: a well-publicized one such as the *Exxon Valdez* or a local one, such as soil contaminated by toxic wastes from a factory. What are the costs of the cleanup? Who is paying the costs? What costs would be incurred if the pollution is not cleaned up? Research findings should be presented to the class, either in the form of a short written report or a poster accompanied by a brief oral report.

Skills emphasis:* *Math I 4, II 3, IV 4, VI 1; Science III 4, V 2, VI 1, VII 2–5*

Suggested for use in: *Environmental Issues, Ecology, Social Studies.*

2 Consider a Natural Resource as an Economic Resource

How much is a swamp or a trout stream worth? The services that natural resources provide are not marketed or given an economic value. Choose a local park, marsh, stream, lake, or other accessible natural resource. Visit the area to observe it. Make a list of all the services it provides. For example, a wooded area of parkland might provide recreation, protect soil from eroding, conserve water, be a source of oxygen and a sink for carbon dioxide, etc. A lake might be a reservoir for drinking water, a source of fish, etc. What legal protections are there for the area? Is the area in danger of being developed or polluted? If so, to what extent would these services be curtailed?

Skills emphasis: *Science III 1, III 4, V 2, VII 2–5*

Suggested for use in: *Ecology, Environmental Issues.*

See chart of Draft National Performance Standards at the beginning of this unit.

3 Follow Commodity Prices

Developing countries are heavily dependent on the export of natural resources. Choose one country in Latin America or Africa. Using an almanac or encyclopedia, find out what its chief natural resources are and what its principal exports are. Use the information in *World Resources 1990–91*, Table 15.4, p. 250, to obtain information about the price of commodities the country exports for the period from 1975 to 1988. Then look in *The Wall Street Journal* or another newspaper to find the current price of the commodity and the price a year ago. Develop a graph showing the prices for each commodity from 1975 to the present. Has each commodity generally risen or fallen in price? What factors have influenced the price of the commodity? What influence has the export of these commodities had on the country's economy?

Skills emphasis: *Geo I 1, Geo IV 11; Math I 4, VI 1, VI 2*

Suggested for use in: *Regional Studies, Geography, Economics.*

Audiovisual Resources

- *An Introduction to Ecological Economics*, VHS, 45 min., Griesinger Films. *This video describes the destructive consequences of national accounting methods, uncontrolled development, and natural resource exhaustion.*
- *Creating Alternative Futures, (1985)*, 12 VHS programs, 30 min. each, Bullfrog Films. *Hazel Henderson, leading futurist and author of "The Politics of the Solar Age," hosts a half-hour discussion with other well-known authors and futurists.*
- *Conversation for a Sustainable Society*, VHS, 43 min., Griesinger Films. *This video describes some of the solutions and suggestions for solving energy and resource problems discussed during the 10th anniversary celebration of the Rocky Mountain Institute.*
- *Investing in Natural Capital*, VHS, 42 min., Griesinger Films. *An exploration of carrying capacity issues related to agriculture, international trade, property rights, and overpopulation.*
- *Super-Companies*, VHS, 57 min., Bullfrog Films. *This video examines how our global economy is being shaped by econ- omic powers that are often at odds with the needs of the people.*
- *Waste Wise*, State Pollution Control Commission (Sydney, Australia, 1989), VHS, 25 min. *Our two heros from the 21st century, when the world's resources have largely disappeared, return to our time to find out why resources dwindled so rapidly.*

Facts About Indonesia and Japan

	Indonesia		Japan	
POPULATION (in millions)				
1960	96.2		94.1	
1990	180.5		123.5	
2025	263.3		128.6	
LIFE EXPECTANCY AT BIRTH (1985-90) (years)	56.0		77.2	
INFANT DEATH RATE (1985-90) (deaths per 1,000 live births)	84		5	
MATERNAL DEATH (annual, from pregnancy, per 100,000 live births)	800		15	
LITERACY RATE (1985)				
Males	83%		99%	
Females	65%		99%	
URBAN/RURAL DISTRIBUTION (1990)				
Urban	28.8%		77.0%	
Rural	71.2%		23.0%	
LABOR FORCE DISTRIBUTION (1980)				
Agriculture	57%		11%	
Industry	13%		34%	
Services	30%		55%	
TRADE (1986) (millions $US)	Import	Export	Import	Export
Live Food	637.5	1,841.1	22,395.3	1,548.5
Raw Materials	996.6	1,984.3	27,677.5	3,387.5
Fuels	1,105.1	8,097.0	39,136.8	782.2
Manufactures	7,979.2	2,864.3	56,838.4	223,336.3
Services	7,489.0	1,551.0	85,490.0	79,730.0
Balance of trade	–$1,837.0		$87,660.	
GROSS NATIONAL PRODUCT (1987) (million $US)	$76,038.0		$1,924,663.0	
PER CAPITA GNP (1987) (US$)	$444.0		$15,764.0	

21

Facts About National Income Accounting

National income accounts provide a framework that countries use to analyze the performance of their economies. These accounts can be used for economic comparisons among different years or among different countries. From these accounts, measures are developed such as:

- *Gross National Product* (GNP). This is the most widely used measure of economic progress. The GNP is the sum of personal consumption expenditure on goods and services plus government expenditure on goods and services plus investment expenditures.
- *Net National Product* (NNP). This is determined by subtracting from the GNP an allowance for depreciation of capital goods. In natural resource accounting, an allowance for the depreciation of natural resources, such as minerals, soils, and forests, is subtracted.

Depreciation

The GNP plays an important role in national policies and in the policies of international lending agencies such as the World Bank. The NNP receives less attention in economic policy planning. It should be used more because deterioration or depletion of capital stock can lead to policy errors with serious long-term results.

Current accounting methods were developed to measure the economies of industrialized countries. Manufactured assets, such as buildings and equipment, are valued as productive capital, and as they wear out, a depreciation charge is taken against the value of the production that these assets generate. Although countries are dependent on natural resources to finance economic growth, the GNP and other indicators of economic progress do not include natural resources. These measurements ignore the consequences of the overexploitation of natural resources and promote the idea that rapid economic growth can be achieved and sustained by exploiting the resource base.

Trends

- Countries are ignoring or destroying the environment in the name of economic development. Government economic policies encourage the destruction of tropical forests, for example. Short-term growth in income is being achieved at the cost of long-term income.
- A few countries are exploring systems of green accounting including: Costa Rica, the Philippines, Indonesia, the People's Republic of China, Mexico, Colombia, India, and Botswana.
- Developed countries investigating systems of national resource accounting include Norway, France, the United States, Canada, Germany, and the Netherlands.

What do "Green Accountants" Want?

- Natural resources and the services they provide should be included in national income accounts.
- All countries, rich and poor, should account for the improvement or deterioration in the stock of natural resources in their measurements of economic growth.
- Natural resource assets should be put into the same balance sheets used for other tangible capital. Depletion and degradation of natural resources should be treated in the same way as depreciation of other forms of physical capital.
- The Net National Product should reflect the depletion of natural resources in the same manner as other depreciation charges. The NNP should be used as well as the GNP to develop national economic policies.
- Key economic institutions such as the World Bank, the International Monetary Fund, and the Organisation for Economic Co-operation and Development (OECD), should begin to compile, use, and publish estimates of net national product and national income. These institutions should prepare to provide technical assistance to national statistical offices in developing countries.
- Environmental protection and effective natural resource management should be incorporated in national economic planning.

What Happens When Natural Resources Are Taken Into Account?

(billions of constant 1973 Rupiah)

Year	GDP*[a]	Net Change in Natural Resources[b]				NDP
		Petroleum	Timber	Soils	Net Change	
1971	5,545	1,527	-312	-89	1,126	6,671
1972	6,067	337	-354	-83	-100	5,967
1973	6,753	407	-591	-95	-279	6,474
1974	7,296	3,228	-533	-90	2,605	9,901
1975	7,631	-787	-249	-85	-1,121	6,510
1976	8,156	-187	-423	-74	-684	7,472
1977	8,872	-1,225	-405	-81	-1,711	7,171
1978	9,567	-1,117	-401	-89	-1,607	7,960
1979	10,165	-1,200	-946	-73	-2,219	6,946
1980	11,169	-1,633	-965	-65	-2,663	8,506
1981	12,055	-1,552	-596	-68	-2,215	9,840
1982	12,325	-1,158	-551	-55	-1,764	10,561
1983	12,842	-1,825	-974	-71	-2,870	9,972
1984	13,520	-1,765	-493	-76	-2,334	11,186
Average Annual Growth	7.1%					4.0%

Source: Robert Repetto, *et al., Wasting Assets: Natural Resources in the National Income Accounts* (World Resources Institute, Washington, D.C., 1989), p. 6.

Notes: a. From the Indonesian Central Bureau of Statistics. b. Includes logs, sawn timber, and plywood.

Which of the following natural resources are included in the above table?

____a. oil ____d. coal

____b. timber ____e. soil

____c. natural gas ____f. copper

2. Which natural resource increased in some years? What might be the reason for this?

3. Which natural resources decreased every year? What are the most likely reasons for the decreases?

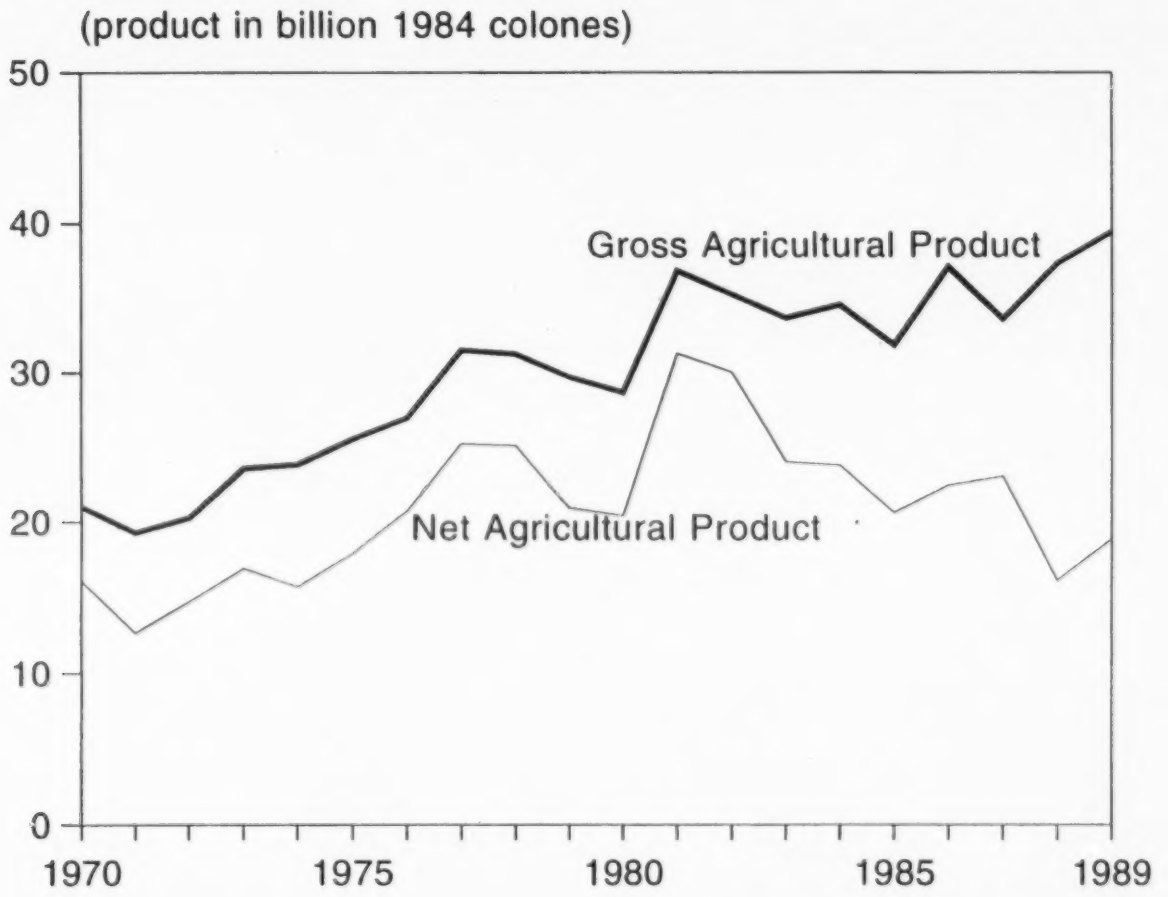
4. What is the average annual growth of the GDP?

5. What is the average annual growth of the NDP?

6. Is the NDP always lower than the GDP?

*GDP and NDP are the same as GNP and NNP minus any earnings a counry makes overseas. Overseas earnings do not affect a country's natural resource base.

Costa Rica's Agricultural Product Before and After Natural Resource Depreciation



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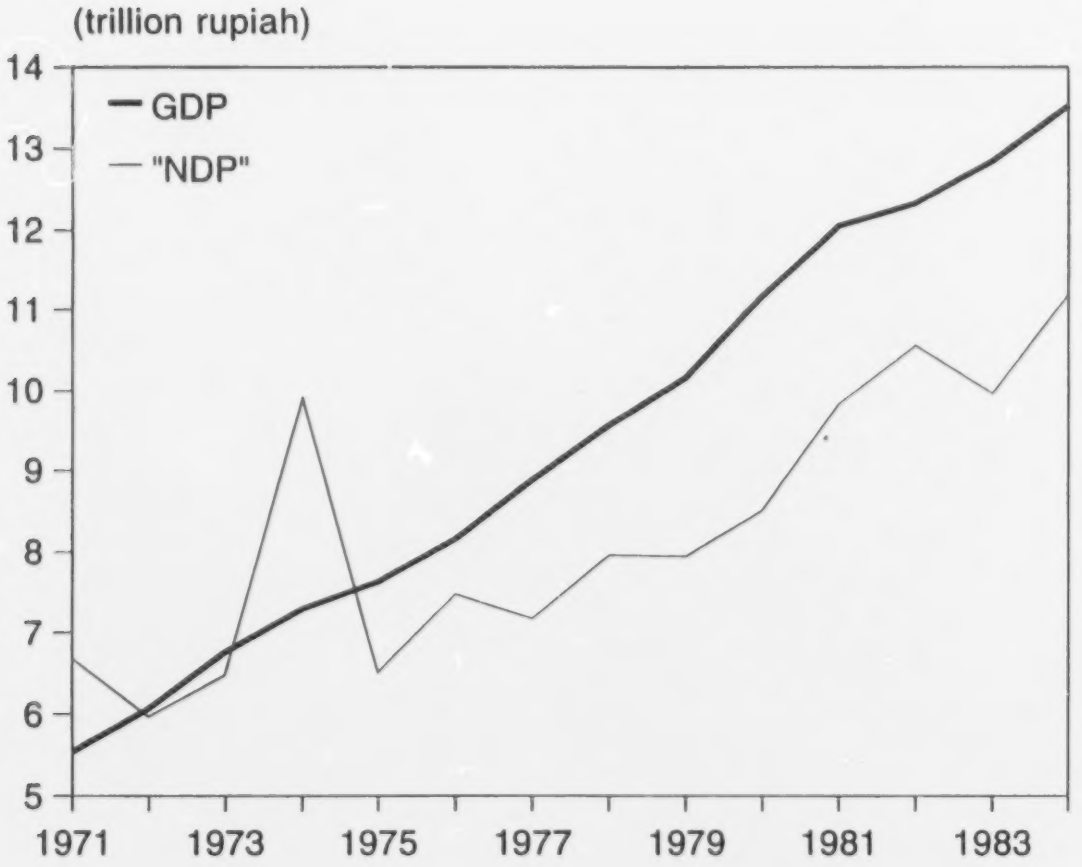
Comparison of Indonesia's Gross Domestic Product and Net Domestic Product



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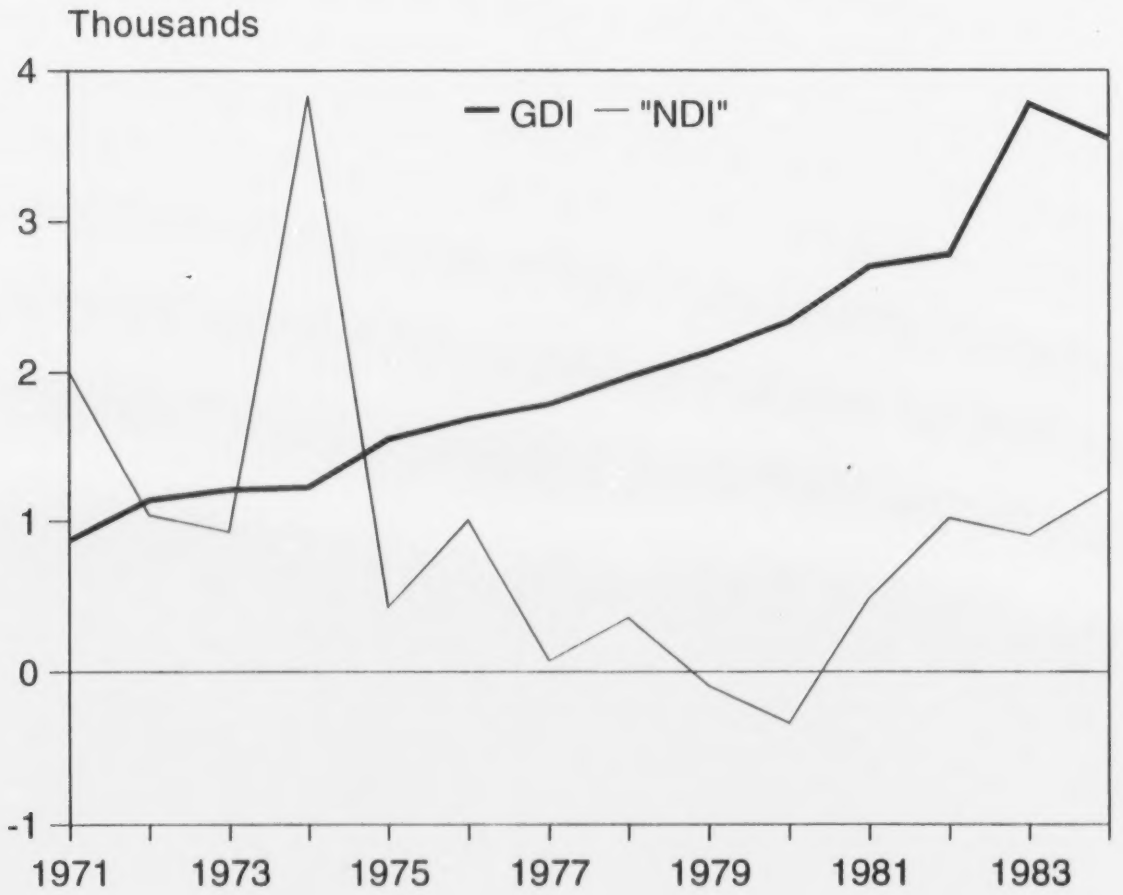
Comparison of Indonesia's Gross Domestic Investment and Net Domestic Investment



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Teacher's Survey
Teacher's Guide Units

(Please use additional paper if necessary)

1. Which *World Resources Teacher's Guide* unit did you use?

____1. Biodiversity
____2. Car Trouble
____3. Citizen Action
____4. Energy, Atmosphere, and Climate
____5. Natural Resource Economics
____6. Oceans and Coasts
____7. Population, Poverty, and Land Degradation
____8. Sustainable Development
____9. Two Giants: China and India
____10. Watershed Pollution
____11. Women, Equity, and Sustainable Development

2. Course(s) in which you used *World Resources Teacher's Guide* units?

____History ____Geography ____Science
____Ecology ____Biology ____Chemistry
____Environmental Studies ____Environmental Science ____Other

3. Which sections of the unit did you find most useful?

____Teaching Strategies
____Student Enrichment Activities
____Student Handouts
____Overhead Transparency Masters
____Reading and AV Lists

4. How much do you think you will use the *World Resources Teacher's Guide* units in the future?

____Often ____Occasionally ____Rarely

5. Did you use the Goals 2000 draft national performance standards to select material from the units?

____Yes ____No

6. If yes to the above question, which performance standards did you teach?_____

_____

7. Were the recommended activities in the unit useful in teaching those standards?

____Yes ____No

8. What features could be added to the *Teacher's Guide* to make it more useful to you?

_____

_____

_____

9. In what setting did you use the *Teacher's Guide* units?

____Middle school ____12th grade ____Nature center
____High School ____Community college ____Zoo
____10th grade ____College or university ____Museum
____11th grade ____Adult education ____Other

10. Was the material appropriate for your audience?

____Yes No, because_____

11. If you used the unit in a school, how much class time did you and your students spend on it?

____Less than 1 class ____2–3 classes ____1–2 weeks

____1 class ____4–5 classes ____More than 2 weeks

12. Do you regularly teach about global environmental issues?

____Yes ____No

13. If you don't regularly teach global environmental issues, did you find this unit offered enough information and materials to construct your lesson?

____Yes No, I also needed_____

14. Did you use other WRI materials with this unit?

____Yes ____No

If yes, which ones_____

15. Because new units of the *Teacher's Guide* are being developed, it is helpful for us to learn how the materials work. Did they engage your students? Prompt lively discussion? Help make what seemed abstract issues vivid? Please be specific with negative *or* positive comments.

_____

_____

_____

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May we call you to discuss your suggestions?

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Sustainable Development Unit / 34 pages
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